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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/510,641	10/08/2004	Khim Hong Ng	3225-103	2900

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WASHINGTON, DC 20005

EXAMINER

GHYKA, ALEXANDER G

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 05/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/510,641

Applicant(s)

NG ET AL.

Examiner

Alexander G. Ghya

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) \_\_\_\_ is/are rejected.
- 7) ☒ Claim(s) 11 and 16 is/are objected to.
- 8) ☒ Claim(s) 1-10, 12-15 and 17-27 are subject to restriction and/or election requirement.

ALEXANDER GHYKA  
PRIMARY EXAMINER

Av 2812  
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## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_.

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 1-10, 12-15 and 17-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al (US 6,346,480) in view of Park (US 5,960,320).**

The present Claims generally require a conductive line for a semiconductor device including a first conductive layer; a titanium layer; and a first titanium rich titanium nitride layer between the first conductive layer and the titanium layer; process claims are also drawn to a process for manufacturing a conductive line comprising the steps of: depositing a titanium layer onto a substrate; depositing a first titanium rich titanium nitride layer to the other side of said titanium layer relative to said substrate;

and depositing a first conductive layer to the other side of said first titanium rich titanium nitride layer relative to said titanium layer.

Yamamoto et al disclose a metal wiring stack comprising 30 nm titanium layer, 100nm titanium nitride, 450 nm aluminum copper alloy/ 15 nm titanium / 50 nm titanium nitride. See Figures 2 A-G and column 5, lines 15-30.

Yamamoto differs from the presently claimed invention in that it does not disclose a titanium rich titanium nitride, instead of the titanium nitride.

Park et al disclose a metal wiring layer comprising titanium nitride as a barrier layer and an aluminum conductive layer. See the Abstract and column 5, lines 5-20. Moreover, Park et al disclose forming the titanium nitride layer into a titanium rich nitride layer so that the aluminum can be deposited free of voids. See the Abstract.

It would have been obvious to one of ordinary skill in the art, at the time of the invention, to form a titanium rich titanium nitride layer in the process of Yamamoto et al, as disclosed by the Park et al reference, for its benefit in depositing a void free aluminum layer. As both references disclose the use of titanium nitride barrier layers around aluminum containing conductive layer, the use of a titanium rich titanium nitride layer for its benefit as disclosed by the Park et al reference (void free aluminum deposition) is *prima facie* obvious.

With respect to Claims 2-3, and 13-15, Yamamoto discloses the layers of aluminum, titanium nitride and titanium are in direct contact with each other. See Figures 2-3.

With respect to Claims 5-6 and 17-19, Yamamoto et al discloses an aluminum copper alloy. See column 3, lines 20-25.

With respect to Claims 8-10 and 20-23, the selection of the thicknesses of the layers is a matter of optimization which would be within the level of one of ordinary skill in the art. .See *In re Antonie*, 195 USPQ 6 (CCPA 1977) .

With respect to Claims 24-27, Yamamoto et al disclose semiconductor devices comprising multi-layer interconnections and discloses silicon substrates. See column 1, lines 10-17, and column 5, lines 20-30.

### ***Allowable Subject Matter***

Claims 11 and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The cited prior art references do not disclose or suggest the location of the second titanium rich titanium nitride layer as claimed by the afore mentioned claims.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander G. Ghyka whose telephone number is (571) 272-1669. The examiner can normally be reached on Monday through Friday during general business hours.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AGG  
May 9, 2006

ALEXANDER GHYKA  
PRIMARY EXAMINER

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